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बाइंडर — विशिष्टि

(पहला पुनरीक्षण)

Indian Standard

ORGANIC NO BAKE (SELF SETTING) BINDERS FOR
USE IN FOUNDRIES — SPECIFICATION

(*First Revision*)

ICS 73.060.01;81.080

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BUREAU OF INDIAN STANDARDS
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Price Group 2

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Foundry and Steel Casting Sectional Committee had been approved by the Metallurgical Engineering Division Council.

Moulds and cores with high degree of dimensional accuracy are commonly made by Using 'Organic No Bake Binder' which are classified broadly into two groups self setting type and gassing type (Cold box). This standard lays down the requirements of organic no bake self setting type Binders. For organic no bake gassing type binders separate Indian Standard exists.

The binder is a resin of one of the following types:

- a) Phenol Base;
- b) Furfuryl alcohol base (Furan); and
- c) Alkyd base.

The hardening is affected by a chemical reaction between the binder and the catalyst without any external heat. In some cases, hardeners or co-binders are also present/required.

Proper choice of the system is necessary for successful production of different types of castings as given below:

- a) *Phenol Base:*
 - 1) Phenol formaldehyde (acid cure) (PNB), application is same as furan.
 - 2) Phenolic polyurethane (PUNB) is suitable for production of castings such as ferrous and non-ferrous.
 - 3) Ester curd alkaline phenolic self setting (APNB) is suitable for production of castings such as steel, cast iron, bronze, brass, aluminium, etc.
- b) *Furfuryl Alcohol Base (Furan):*

Furan (FNB) is suitable for production of castings such as steel, cast iron, and copper based alloys. But it is not very much suitable for production of light metal alloy castings.
- c) *Alkyd Base:*

Alkyd resin (oil based) is suitable for production of castings such as steel, cast iron and non-ferrous.

On curing, the phenolic system (Ester and acid cured) turns to pink, the furan system turns to green and the alkyd and phenolic polyurethane systems do not change from the original colour of the sand.

The resin containing more than 5 percent phenol is toxic in nature and hardener as a isocyanate is also toxic in nature. A proper guidance for safe handling shall be provided by the manufacturer.

Physical Information:

The manufacturer shall provide a test certificate containing following information:

- a) Appearance;
- b) Colour;
- c) Density;
- d) Viscosity;
- e) Manufacturing date;
- f) Expiry date; and
- g) Storage temperature range.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Indian Standard***ORGANIC NO BAKE (SELF SETTING) BINDERS FOR
USE IN FOUNDRIES — SPECIFICATION***(First Revision)***1 SCOPE**

This standard covers the requirements for organic no bake self setting type binders for use in foundries.

2 REFERENCES

The standards listed below contain provisions which, through reference in this text constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreement based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below:

<i>IS No.</i>	<i>Title</i>
1387 : 1993	General requirements for the supply of metallurgical materials (<i>second revision</i>)
1918 : 1966	Methods of physical tests for foundry sands
3018 : 1977	Specification for standard silica sand for raw material testing in foundries
4905 : 1968	Methods for random sampling

3 SUPPLY OF MATERIAL

General requirements relating to the supply of organic no bake binders shall be as specified in IS 1387.

4 REQUIREMENTS

Viscosity of binder when tested by Ford Cup Viscometer No. 4 shall be as per Table 1.

5 REQUIREMENT OF PHYSICAL PROPERTIES OF STANDARD SAND MIX

The physical properties of sand, binder and hardener mix, when tested according to the procedure specified in Annex A shall be as given in Table 2 for the different types of binder systems.

6 SAMPLING

Sampling procedure and the criteria for conformity shall be as given in Annex B.

7 STORAGE QUALITY

The user shall store the materials as stipulated by the manufacturer. The period for which a 'no bake' binder system may be stored without deterioration shall be indicated on the containers by the manufacturer. Within the shelf-life period, if the material does not meet the requirements given in 3 and 4 shall be declared as not complying with this standard, even though the lot might have been accepted after testing on its arrival.

8 PACKING

The material shall be packed in a suitable container with which material shall not react.

9 MARKING

9.1 The containers shall be legibly marked with the name and type of the material, quantity, manufacturer's name, production batch number, date of manufacturing and date of expiry.

Table 1 Viscosity Requirement of Binders
(Clause 4)

Sl No.	Binder	Acid Cured Phenolic	Phenolic Polyurethane	Ester Cured Alkaline Phenolic	Furan	Alkyd Resin (Oil Based)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Maximum viscosity (at 30°C, B4 cup at the time of receipt)	60	50	40	30	250
ii)	Maximum free formaldehyde content of liquid resin (oxime method), percent	1	1	0.5	1	—
iii)	Viscosity within stipulated storage life	Less than 150 s or layer separation — whichever is earlier	Not greater than 80 in sealed condition	Not greater than 75	Not greater than 50	Not greater than 300 in sealed condition

Table 2 Strength Requirement of Binders
(Clause 5)

Sl No.	Resin Type Physical Properties	Acid Cured Phenolic (PNB)	Phenolic Polyurethane (PUNB)	Ester Cured Alkaline Phenolic (APNB)	Furan (FNB)	Alkyd Resin (Oil Based)	Test to Determine
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	Minimum time in min, to attain compress ion strength of 0.010 MPa on 50 mm × 50 mm test piece	8	15	10	30	25	Bench life/working time
ii)	Deformation after stripping	The core shall not sag or deform	The core shall not sag or deform	The core shall not sag or deform	The core shall not sag or deform	The core shall not sag or deform	Thorough hardening
iii)	Minimum compression strength after 240 min in MPa	1.24	1.72	1.24	1.03	1.10	Strength
iv)	Minimum shear strength after 240 min in MPa	0.41	0.57	0.41	0.34	0.37	Strength
v)	Gas content, ml/g, Max	20	20	22	20	22	Gas content

NOTE — 1 MPa = 1 N/mm² = 1 MN/m² = 0.102 0 kgf/mm².

9.2 BIS Certification Marking

The material may also be marked with the Standard Mark.

9.2.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 1986

and Rules and Regulations made thereunder. The details of conditions under which the licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

ANNEX A (Clause 5)

METHODS OF TEST FOR ORGANIC NO BAKE BINDERS

A-1 RAW MATERIALS REQUIRED

- Sand* — Silica sand as specified in IS 3018 shall be used.
- Resin* — The binder used under test.
- Catalyst* — Specified catalyst for the binder under test.

A-2 APPARATUS

- A paddle type sand mixer shall be used;
- Standard sand testing equipments for physical testing of sand;
- Mould strength tester;
- Wooden core box 200 mm dia × 250 mm height; and
- Gas determinator.

A-3 RECOMMENDED SANDMIX

- Sand : 5-15 kg
- Binder : 2.0 percent of sand
- Catalyst : 20 percent of binder

A-3.1 In case of alkyd base binder (without accelerator) is available, a separate addition of 5 percent accelerator, based on binder shall be added after pre-mixing with the binder alone.

A-3.2 For alkyd base binder (with accelerator) the sand mix as given in **A-3** shall be used.

A-4 MIXING PROCEDURE

A required quantity of sand shall be charged in the dry and clean mixer. A calculated quantity of catalyst shall be added uniformly over the sand bed while mixer is running and shall be mixed for 2 min. Similarly, the binder shall be added to the sand bed and shall be mixed for 3 min. Then, the mixture shall be discharged in a clean bucket.

A-5 TESTING PROCEDURE

A-5.1 Test for Bench Life

Eight numbers of 50 × 50 mm standard sand sample shall be prepared very quickly from the mix, using split specimen tube and tested at an interval of 5 min for

compression strength. The stripping of the sand specimen shall be done just prior to testing. 0.010 MPa GCS (Green Compressive Strength) indicated the end of bench life.

Alternative Method

Eight numbers of 50 × 50 mm standard sand sample shall be prepared at an interval of 5 min from the mix using split specimen tube. After 4 h from the time of

preparing each sample, the samples are to be tested for compression strength. The GCS should be minimum 0.551 MPa. Duration shall be in minutes, of the last sample which pass this criteria will be considered for the bench life of sand mix.

A-5.2 Other tests shall be carried out as per standard testing procedure adopted in foundry sand testing (*see* IS 1918).

ANNEX B

(Clause 6)

SAMPLING AND CRITERIA FOR CONFORMITY

B-1 LOT

In any consignment, all the containers/bags containing material of the same type and grade, manufactured by the same firm under similar condition of productin shall be grouped together to constitute a lot.

B-2 SCALE OF SAMPLING

B-2.1 The number of containers, to be selected, shall be according to col 2 and 3 of Table 3.

B-2.2 The containers shall be selected at random. For this purpose, the provisions given in IS 4905 shall be used.

B-3 PREPRATION OF TEST SAMPLES

From each of the selected containers, as per col 2 and 3 of Table 3 with the help of a suitable sampling instrument 0.5 kg material shall be taken. This material

shall be taken from the top, centre and bottom of each selected containers. Samples taken from each container shall be mixed to form a composite sample of 2.5 kg. By coning and quartering division method the 2.5 kg shall be reduced to give a final test sample of 300 g. The sample, thus obtained shall be divided into three equal portions, one for the purchaser, the second for the manufacturer and the third shall be kept as a referee sample.

Table 3 Scale of Sampling

(Clause B-2.1)

Sl No. (1)	No. of Containers to be in the Lot (2)	No. of Containers to be Selected (3)
i)	Up to 100	5
ii)	101-300	8
iii)	301-500	13
iv)	501 and above	20

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